

CLAIMS

1. A coating composition comprising:

(A) 100 weight parts of at least one epoxy resin;

(B) 3-300 weight parts of at least one aminofunctional silicone resin comprising the units:

5 $(R_3SiO_{1/2})_a$ (i) $(R_2SiO_{2/2})_b$ (ii) $(RSiO_{3/2})_c$ (iii) and $(SiO_{4/2})_d$ (iv)

wherein R is independently an alkyl group, an aryl group, or an aminofunctional hydrocarbon group, a has a value of less than 0.4, b has a value of greater than 0.15, c has a value of greater than zero to 0.7, d has a value of less than 0.2, the value of $a + b + c + d = 1$, with the provisos that 3 to 50 mole percent of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the $-NH-$ equivalent weight of the aminofunctional silicone resin is from 100 to 1500, the aminofunctional silicone resin is in the form of a neat liquid, solution, or meltable solid, greater than 20 weight percent of unit (ii) is present in the aminofunctional silicone resin, less than 10 weight percent of unit (ii) are $Me_2SiO_{2/2}$ units in the aminofunctional silicone resin, and greater than 50 weight percent of silicon-bonded R groups are silicon-bonded aryl groups;

(C) up to 50 weight parts of at least one organic hardener;

20 (D) up to 100 weight parts of at least one epoxyfunctional silicone resin comprising the units:

 $((R^3)_3SiO_{1/2})_e$ (i) $((R^3)_2SiO_{2/2})_f$ (ii) and $((R^3)SiO_{3/2})_g$ (iii)

wherein R^3 is independently an alkyl group having from 1 to 8 carbon atoms, an aryl group having from 1 to 8 carbon atoms, a glycidyl ether group, an alkyl epoxy group, or a cycloaliphatic epoxy group, e has a value of 0.1 to 0.5, f has a value of 0.1 to 0.5, and g has a value of 0.5 to 0.9, with the proviso that the epoxyfunctional silicone resin has an epoxy equivalent weight of 200 to 700; and

(E) up to 10 weight parts of at least one cure accelerator.

2. A coating composition comprising:

(A) 100 weight parts of at least one epoxy resin;

(B) 3-300 weight parts of at least one aminofunctional silicone resin comprising the units:

$(R_3SiO_{1/2})_a$ (i)

5 $(R_2SiO_{2/2})_b$ (ii)

$(RSiO_{3/2})_c$ (iii) and

$(SiO_{4/2})_d$ (iv)

wherein R is independently an alkyl group, an aryl group, or an aminofunctional hydrocarbon group, a has a value of less than 0.4, b has a value of greater than 0.15, c has a value of greater than zero to 0.7, d has a value of less than 0.2, the value of $a + b + c + d = 1$, with the provisos that 3 to 50 mole percent of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the $-NH-$ equivalent weight of the aminofunctional silicone resin is from 100 to 1000, the aminofunctional silicone resin is in the form of a neat liquid, solution, or meltable solid, greater than 20 weight percent of unit (ii) is present in the aminofunctional silicone resin, less than 10 weight percent of unit (ii) are $Me_2SiO_{2/2}$ units in the aminofunctional silicone resin, and greater than 50 weight percent of silicon-bonded R groups are silicon-bonded aryl groups;

(C) up to 50 weight parts of at least one organic hardener;

(D) up to 100 weight parts of at least one epoxyfunctional silicone resin comprising the units:

20 $((R^3)_3SiO_{1/2})_e$ (i)

$((R^3)_2SiO_{2/2})_f$ (ii) and

$((R^3)SiO_{3/2})_g$ (iii)

wherein R^3 is independently an alkyl group having from 1 to 8 carbon atoms, an aryl group having from 1 to 8 carbon atoms, a glycidyl ether group, an alkyl epoxy group, or a cycloaliphatic epoxy group, e has a value of 0.1 to 0.5, f has a value of 0.1 to 0.5, and g has a value of 0.5 to 0.9, with the proviso that the epoxyfunctional silicone resin has an epoxy equivalent weight of 200 to 700; and

(E) up to 10 weight parts of at least one cure accelerator.

3. A composition according to Claim 1 or 2 wherein component (A) is selected from diglycidyl ether resin, novolak epoxy resin, o-cresol novolak epoxy resins, phenol novolak epoxy resins, cycloaliphatic epoxy resins, glycidyl ethers of polyvalent phenols, glycidyl ethers of resorcinol, glycidyl ethers of hydroquinone, glycidyl ethers of catechol, polyglycidyl ethers of phenol novolak epoxy resins alicyclic epoxy resins derived from the epoxidation of an olefin bond, the product of the reaction of 2,2-bis-(hydroxy-phenyl)-propane (bisphenol A) and epichlorohydrin, triglycidyl isocyanurate, or products obtained from the reaction of bis-(4-hydroxy-phenyl)-methane (bisphenol F) and epichlorohydrin.

4. A composition according to any of Claims 1 - 3 wherein R is independently selected from methyl, phenyl, or an aminofunctional hydrocarbon group having the formula $-R^1NHR^2$ or $-R^1NHR^1NHR^2$ wherein each R^1 is independently a divalent hydrocarbon radical having at least 2 carbon atoms and R^2 is hydrogen or an alkyl group.

5. A composition according to any of Claims 1-4 wherein Component (B) is selected from

aminofunctional silicone resins comprising the units:

- (i) $((CH_3)_3SiO_{1/2})_a$
- (ii) $(C_6H_5(CH_3)SiO_{2/2})_b$
- (iii) $((CH_3)RSiO_{2/2})_b$ where $R = -CH_2CH_2CH_2NH_2$
- (iv) $(C_6H_5SiO_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $(C_6H_5(CH_3)SiO_{2/2})_b$
- (ii) $((CH_3)RSiO_{2/2})_b$ where $R = -CH_2CH_2CH_2NH_2$
- (iii) $(C_6H_5SiO_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((CH_3)_3SiO_{1/2})_a$
- (ii) $((CH_3)RSiO_{2/2})_b$ where $R = -CH_2CH_2CH_2NH_2$
- (iii) $(RSiO_{3/2})_c$ where $R = -CH_2CH_2CH_2NH_2$
- (iv) $(C_6H_5SiO_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$

5 aminofunctional silicone resin comprising the units

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $(\text{CH}_3)_2\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$

10 aminofunctional silicone resin comprising the units:

- (i) $((\text{CH}_3)_2\text{RSiO}_{1/2})_a$ where $\text{R} = -\text{CH}_2(\text{CH}_3)\text{CHCH}_2\text{NHCH}_3$
- (ii) $(\text{CH}_3)_2\text{SiO}_{2/2})_b$
- (iii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$

15 aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_2\text{RSiO}_{1/2})_a$ where $\text{R} = -\text{CH}_2(\text{CH}_3)\text{CHCH}_2\text{NHCH}_3$
- (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- 20 (i) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2(\text{CH}_3)\text{CHCH}_2\text{NHCH}_3$
- (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_2\text{RSiO}_{1/2})_a$ where $\text{R} = -\text{CH}_2(\text{CH}_3)\text{CHCH}_2\text{NHCH}_3$
- 25 (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $(\text{SiO}_{4/2})_d$, or

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 5 (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$
- (v) $(\text{SiO}_{4/2})_d$

wherein a, b, c, and d are as defined above.

6. A composition according to any of Claims 1-4 wherein Component (B) is selected from aminofunctional silicone resins comprising the units:

- 10 (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- 15 (i) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- 20 (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iii) $(\text{RSiO}_{3/2})_c$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- 25 (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$, or

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 5 (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$
- (v) $(\text{SiO}_{4/2})_d$

wherein a, b, c, and d are as defined above.

7. A composition according to any of Claims 1-6 wherein a has a value of 0.1 to 0.3, b
 10 has a value of 0.2 to 0.4, c has a value of 0.2 to 0.5, d has a value of 0, 10 to 30 mole percent
 of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the –
 NH- equivalent weight of the aminofunctional silicone resin is from 150 to 350, 20 to 50
 weight percent of unit (ii) is present in the aminofunctional silicone resin, 0 to 5 weight
 percent of unit (ii) are $\text{Me}_2\text{SiO}_{2/2}$ units in the aminofunctional silicone resin, and from 50 to
 15 75 weight percent of silicon-bonded R groups are silicon-bonded aryl groups.

8. A composition according to any of Claims 1-7 wherein Component (C) is selected
 from multifunctional primary polyamines, multifunctional secondary polyamines, adducts of
 multifunctional primary polyamines, adducts of multifunctional secondary polyamines,
 20 anhydrides, or polyamides.

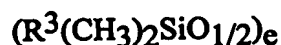
9. A composition according to any of Claims 1-8 wherein R^3 is independently
 selected from methyl, phenyl, 2-glycidoxyethyl, 3-glycidoxypropyl,
 4-glycidoxybutyl, 2-(3,4-epoxycyclohexyl)ethyl, 2,3-epoxypropyl, 3,4-epoxybutyl,
 25 4,5-epoxypentyl, 3,4-epoxycyclohexylmethyl, 3,4-epoxycyclohexylethyl,
 3,4-epoxycyclohexylpropyl, 3,4-epoxycyclohexylbutyl, or alkyl cyclohexene oxide groups.

10. A composition according to any of Claims 1-9, wherein Component (D) is selected from

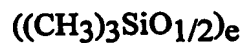
epoxyfunctional silicone resins comprising the units:



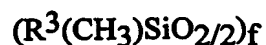
epoxyfunctional silicone resins comprising the units:



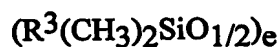
epoxyfunctional silicone resins comprising the units:



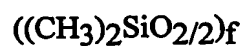
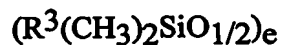
15 epoxyfunctional silicone resins comprising the units:



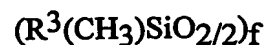
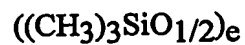
epoxyfunctional silicone resins comprising the units:



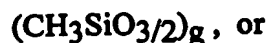
epoxyfunctional silicone resins comprising the units:



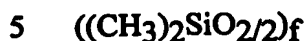
25 epoxyfunctional silicone resins comprising the units:



epoxyfunctional silicone resins comprising the units:



epoxyfunctional silicone resins comprising the units:



wherein R^3 is a glycidyl ether group, an alkyl epoxy group, or a cycloaliphatic epoxy group, e has a value of 0.1 to 0.5, f has a value of 0.1 to 0.5, and g has a value of 0.5 to 0.9, with the proviso that the epoxyfunctional silicone resin has an epoxy equivalent weight of 200 to 700.

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11. A composition according to any of Claims 1-10 wherein Component (E) is selected from phosphine compounds, phosphonium salts, imidazoles, imidazolium salts, amines, ammonium salts, diazabicyclo compounds, tetraphenylborates, phenol salts, phenol novolak salts, 2-ethylhexanoates of diazabicyclo compounds, alcohols, dicyandiamide, or
15 boron trifluoride.

12. A composition according to any of Claims 1-11, wherein the -NH- equivalent weight to epoxy ring equivalent weight ratio is from 0.8:1-1.2:1.

20 13. A composition according to any of Claims 1-12 wherein the coating compositions further comprise (F) at least one surfactant.

14. A composition according to Claim 13 wherein the composition further comprises (G) water.

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15. A composition according to Claim 14 wherein the composition is in the form of an emulsion.

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16. A composition according to any of Claims 1-15 wherein the composition further comprises at least one ingredient selected from fragrances, preservatives, vitamins, ceramides, amino-acid derivatives, liposomes, polyols, botanicals, conditioning agents, glycols, vitamin A, vitamin C, vitamin E, Pro-Vitamin B5, sunscreen agents, humectants, 5 preservatives, emollients, occlusive agents, esters, pigments, or self-tanning agents.

17. A composition according to Claim 16 wherein the emulsion is in the form of spray-dried composite particles.

18. A coating composition obtained by a method comprising reacting:

(A) 100 weight parts of at least one epoxy resin;

(B) 3-300 weight parts of at least one aminofunctional silicone resin comprising the units:

$(R_3SiO_{1/2})_a$ (i)

5 $(R_2SiO_{2/2})_b$ (ii)

$(RSiO_{3/2})_c$ (iii) and

$(SiO_{4/2})_d$ (iv)

wherein R is independently an alkyl group, an aryl group, or an aminofunctional hydrocarbon group, a has a value of less than 0.4, b has a value of greater than 0.15, c has a value of greater than zero to 0.7, d has a value of less than 0.2, the value of $a + b + c + d = 1$, with the provisos that 3 to 50 mole percent of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the $-NH-$ equivalent weight of the aminofunctional silicone resin is from 100 to 1500, the aminofunctional silicone resin is in the form of a neat liquid, solution, or meltable solid, greater than 20 weight percent of unit (ii) is present in the aminofunctional silicone resin, less than 10 weight percent of unit (ii) are $Me_2SiO_{2/2}$ units in the aminofunctional silicone resin, and greater than 50 weight percent of silicon-bonded R groups are silicon-bonded aryl groups;

(C) up to 50 weight parts of at least one organic hardener;

(D) up to 100 weight parts of at least one epoxyfunctional silicone resin comprising the units:

20 $((R^3)_3SiO_{1/2})_e$ (i)

$((R^3)_2SiO_{2/2})_f$ (ii) and

$((R^3)SiO_{3/2})_g$ (iii)

wherein R^3 is independently an alkyl group having from 1 to 8 carbon atoms, an aryl group having from 1 to 8 carbon atoms, a glycidyl ether group, an alkyl epoxy group, or a cycloaliphatic epoxy group, e has a value of 0.1 to 0.5, f has a value of 0.1 to 0.5, and g has a value of 0.5 to 0.9, with the proviso that the epoxyfunctional silicone resin has an epoxy equivalent weight of 200 to 700; and

(E) up to 10 weight parts of at least one cure accelerator.